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# *CITHARICHTHYS ABBOTTI*, A NEW FLATFISH (BOTHIDAE) FROM THE SOUTHWESTERN GULF OF MEXICO

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I have recently collected a number of specimens of a flatfish, referable to the bothid genus *Citharichthys* Bleeker, from coastal waters of Veracruz and Campeche, México. It was impossible to identify this fish by means of existing revisionary studies or keys (Parr, 1931; Norman, 1934; Gutherz, 1967) and comparison with its most closely related western Atlantic congeners reveals significant differences in a number of meristic and morphological characters. In view of its apparent abundance on the Mexican coast and the possibility of its confusion with related Gulf of Mexico and Caribbean forms, I take this opportunity to describe this new species and to provide comparative notes on *C. spilopterus* Günther and *C. arenaceus* Evermann and Marsh.

Type material has been deposited in the collections of the following institutions: United States National Museum (USNM); Academy of Natural Sciences of Philadelphia (ANSP); Museum of Comparative Zoology (MCZ); University of Miami, Institute of Marine Science (UMML); Instituto Nacional de Investigaciones Biológico Pesqueras, México (INIBP) and the Gulf Coast Research Laboratory (GCRL).

Measurements were made with dial calipers or ocular micrometer and recorded to the nearest 0.1 mm. Morphometric criteria requiring special definition are as follows: standard length (SL)—anteriormost tip of premaxillary to rear of hypural; head length (HL)—tip of premaxillary to posteriormost fleshly margin of opercle; body depth—maximum vertical dis-

tance between dorsal and anal fin bases; pectoral fin length—base of first (dorsad) ray to tip of longest ray; pelvic fin length—insertion of anteriormost ray to tip of longest ray; diameter of orbit—maximum longitudinal distance between bony margins of right (dorsad) orbit; eye diameter—maximum longitudinal diameter of left eye; snout length—anterior margin of orbit to tip of premaxillary; postorbital length—posterior margin of orbit to tip of opercle; upper jaw length—tip of premaxillary to posteroventral margin of maxillary; lower jaw length—anterodorsal tip of dentary to rear of retroarticular angle; length of 1st dorsal ray—from anterior angle of insertion to tip. Scale counts include the number of pored lateral line scales from upper opercular angle to rear of hypural. Gill raker counts are those of the 1st left side arch and include rudiments as well as fully developed rakers. A raker located at the angle is included in the count of the lower arch. Tabulated meristic counts are based on material examined during this study. Description and drawings of dentition are from cleared, stained and dissected specimens (100–115 mm SL). Statistical analyses were run on an IBM 1130–2B 8K computer.

**Citharichthys abbotti** new species
(Fig. 1)

*Holotype*: USNM 203735; 142.6 mm SL; México, Veracruz, from eddy current at mouth of Laguna de Zontecomapan; ichthyocide collection over sand bottom in depths up to 2 meters; 1 September 1967; C. E. Dawson and W. Abbott coll.

*Paratypes*: ANSP *112317*; (2) 74–83 mm SL. GCRL 2436; (3) 64–132 mm SL. GCRL 2808; (2) 103–112 mm SL, cleared and stained. MCZ *46368*; 83 mm SL. UMML *24484*; (2) 79–90 mm SL. USNM *203736*; (6) 28–127 mm SL. INIBP uncat.; 76 mm SL. Collection data of foregoing paratypes as for holotype. USNM 203737; (12) 24–65 mm SL; from tidepool on north side of south jetty at Alvarado, approx. 18°47′30″N, 95°45′07″W; 7 June 1968; C. E. Dawson coll. USNM *203738*; (6) 23–94 mm SL; Campeche, east shore of Rio San Pedro, near mouth, approx. 18°41′45″N, 92°27′15″W; 10 June 1968; C. E. Dawson coll.

*Other material*: México, Veracruz—GCRL 2382; (5) 13–17 mm SL; Isla da Amor, Boca del Rio; 4 September 1967; C. E. Dawson coll. GCRL 2368, 2685; (3) 126–138 mm SL; Gulf of Mexico beach just south of Boca del Rio; 4 September 1967; C. E. Dawson and seine crew coll. GCRL 2435; (5) 13–18 mm SL; Rio Jamapa, approx. 0.5 mi. from mouth;

FIG. 1. *Citharichthys abbotti* USNM 203736; paratype; 116.0 mm SL.

4 September 1967; C. E. Dawson and S. Romay coll. GCRL 2733; (20) 15–75 mm SL; Isla da Amor, Boca del Rio, approx. 19°05′32″N, 96°06′ W; 5 June 1968; C. E. Dawson coll. GCRL 2759; (27) 20–62 mm SL; north shore of Isla Pajaritos, Rio Coatzacoalcos, approx. 18°07′21″N, 94°25′02″W; 8 June 1968; C. E. Dawson coll. GCRL 2758, 2807; (45) 16–45 mm SL, (3) cleared and stained; mouth of Laguna de Zontecomapan; 16 August 1968; C. E. Dawson coll.

México, Campeche—GCRL 2802; 51 mm SL; Zacatal, just north of ferry landing, approx. 18°37′N, 91°51′45″W; 9 June 1968; C. E. Dawson coll.

*Diagnosis*: A species of *Citharichthys* lacking osseous protuberances or spines on snout or orbital rims; modally with 22 caudal vertebrae and combinations of 76 dorsal and 56 anal fin rays, 20 gill rakers on the first arch and 44–45 lateral line scales; without prominent or distinctive coloration; first dorsal ray inserted close to anterior blind side naris, its length averages 8 percent of SL; snout about 30 percent longer than eye, subequal to diameter of orbit; body depth averages 47 percent of SL, left pelvic fin averages 12 percent of SL and the upper jaw averages 37 percent of HL.

*Description*: Dorsal rays 72–81, usually 75–78; anal rays 52–60, usually 55–56, gill rakers 5–8 + 13–16 = 18–23, usually 6 + 14 = 20; left pectoral fin 9–11, usually 10; right pectoral fin 8–10, usually 9; pelvic fins 6; segmented caudal fin rays 17; lateral line scales 42–49, usually 44–45; vertebrae 9–11 + 21–23 = 31–33, usually 10 + 22 = 32.

Measurements (mm) of holotype are as follows: caudal fin length 32.6, depth of caudal peduncle 19.3, body depth 69.2, left pectoral fin length 18.1, right pectoral fin length 16.7, left pelvic fin length 18.1, right

TABLE 1. Frequency distribution of dorsal and anal fin rays in *Cytharichthys abbotti*, *C. arenaceus* and *C. spilopterus*. (Holotype marked *; $\bar{x}$ = mean; $\sigma$ = standard deviation).

| | | Dorsal rays | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | N | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | $\bar{x}$ | $\sigma$ |
| *abbotti* | 132 | | | 1 | 5 | 13 | 23 | 30 | 23 | 23* | 11 | 2 | 1 | | 76.3 | 1.73 |
| *arenaceus* | 45 | 1 | 2 | 11 | 10 | 9 | 7* | 3 | 2 | | | | | | 73.4 | 1.60 |
| *spilopterus* | 87 | | | | | 2 | 1 | 9 | 20 | 20 | 16 | 17* | 6 | 3 | 78.3 | 1.78 |

| | | Anal rays | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | N | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | | $\bar{x}$ | $\sigma$ |
| *abbotti* | 132 | | 1 | 5 | 13 | 37 | 35 | 22 | 14* | 4 | 1 | | | | 55.8 | 1.46 |
| *arenaceus* | 46 | 1 | 11 | 8 | 14 | 9* | 3 | | | | | | | | 53.6 | 1.29 |
| *spilopterus* | 87 | | | | | | 8 | 9 | 20 | 23 | 17* | 7 | 3 | | 58.7 | 1.50 |

pelvic fin length 16.7, length of first dorsal ray 11.1, head length 40.8, diameter of bony orbit 7.7, eye diameter 5.8, width of bony interorbital 2.1, anterodorsal margin of orbit to dorsal fin base 3.0, postorbital length 26.2, upper jaw length 15.5, lower jaw length 18.1. See Tables 1–4 for additional counts and measurements.

Body elongate, oval, its greatest depth (44–51 percent of SL) near a vertical from 10th or 11th anal ray; slender, its greatest thickness 7.4 per-

TABLE 2. Frequency distribution of upper, lower, and total gill rakers in *C. abbotti*, *C. arenaceus*, and *C. spilopterus*. (Holotype marked *; $\bar{x}$ = mean; $\sigma$ = standard deviation).

| | | Upper arch | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | N | 3 | 4 | 5 | 6 | 7 | 8 | $\bar{x}$ | $\sigma$ |
| *abbotti* | 89 | | | 10 | 44* | 32 | 3 | 6.3 | 0.72 |
| *arenaceus* | 40 | 1 | 6* | 19 | 12 | 2 | | 5.2 | 0.85 |
| *spilopterus* | 85 | 19 | 53* | 13 | | | | 3.9 | 0.61 |

| | | Lower arch | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | N | 11 | 12 | 13 | 14 | 15 | 16 | $\bar{x}$ | $\sigma$ |
| *abbotti* | 89 | | | 18 | 33* | 30 | 8 | 14.3 | 0.90 |
| *arenaceus* | 40 | | 9 | 23* | 7 | 1 | | 13.0 | 0.72 |
| *spilopterus* | 85 | 5 | 19 | 37 | 14* | 10 | | 13.0 | 1.05 |

| | | Total | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | N | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | $\bar{x}$ | $\sigma$ |
| *abbotti* | 89 | | | | | | 1 | 12 | 31* | 27 | 13 | 5 | 20.6 | 1.10 |
| *arenaceus* | 40 | | | 1 | 3 | 10* | 16 | 6 | 3 | 1 | | | 17.9 | 1.22 |
| *spilopterus* | 85 | 1 | 4 | 12 | 19 | 27 | 16* | 6 | | | | | 16.6 | 1.32 |

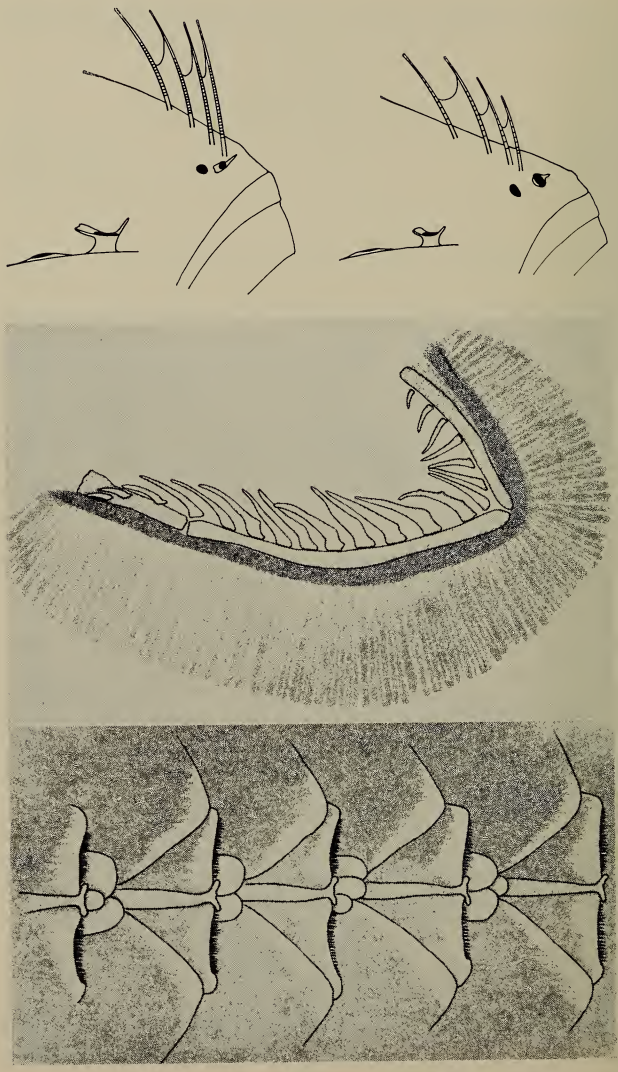
TABLE 3. Frequency distribution of lateral line scales in *Citharichthys abbotti, C. arenaceus,* and *C. spilopterus.* (Holotype marked *; $\bar{x}$ = mean; $\sigma$ = standard deviation).

| Species | N | Lateral line scales | | | | | | | | | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | | |
| *abbotti* | 51 | 1 | 6 | 14* | 14 | 7 | 7 | 1 | 1 | | 44.9 | 1.46 |
| *arenaceus* | 27 | | | | 1 | | 7 | 7* | 6 | 6 | 48.2 | 1.30 |
| *spilopterus* | 28 | | 2 | 8 | 11 | 3 | 2 | 2 | | | 45.0 | 1.29 |

cent of SL; caudal peduncle short, its depth averages 13 percent of SL. Anterodorsal profile broadly rounded, a slight notch before the eye; lower jaw slightly included anteriad but with the anteroventral angle of dentary projecting slightly in advance of premaxillary; posterior edge of maxillary reaches a vertical through the posterior 1/6 of left eye and posterior edge of right eye; right eye slightly in advance of left, well removed from dorsal fin base; fleshy interorbital broad, its width somewhat more than 1/2 eye diameter; bony interorbital with a slight ridge along margin of left orbit, not continued on snout which is broad and distinctly longer than eye. Dorsal fin originates on right side (Fig. 2), about 2/3 of eye diameter in advance of the right eye, just above or slightly in advance of the anterior naris and about 1/2 an eye diameter ventrad of the snout margin; first two dorsal rays closely spaced, interspace between 1st and 2nd rays about 1/2 that between 2nd and 3rd; adpressed 1st dorsal ray reaches base of 7th ray; longest dorsal and anal rays about 12 and 13 percent of SL, respectively; left side nares small (0.6 mm in diameter), the posterior with a slightly raised margin, the anterior a short tubule with a flaplike expansion of its rear margin and a slender tendril anteriad; right side nares similar to those of left but the diameter of the posterior naris is slightly larger (0.7 mm) than that of the anterior (0.5 mm). Left pectoral fin obliquely rounded, the 4th and 5th rays the longest, reaches a vertical from 32nd or 33rd dorsal ray; right pectoral fin smaller, narrowly rounded, the middle rays the longest; left pelvic fin broad, its 2nd and longest ray reaches to between bases of 5th and 6th anal rays; right pelvic fin smaller; its 4th ray reaches base of 2nd anal ray; anus and urinary papilla on right side adjacent to anal fin origin.

TABLE 4. Frequency distribution of caudal vertebrae in *Citharichthys abbotti, C. arenaceus,* and *C. spilopterus.* All data are from radiographs and include terminal vertebra bearing hypural. (Holotype marked *).

| Species | N | Caudal vertebrae | | | | | $\bar{x}$ |
|---|---|---|---|---|---|---|---|
| | | 21 | 22 | 23 | 24 | 25 | |
| *abbotti* | 124 | 19 | 96* | 9 | | | 21.9 |
| *arenaceus* | 49 | 3 | 38* | 8 | | | 22.1 |
| *spilopterus* | 68 | | | 11 | 54 | 3 | 23.8 |



Gill rakers (Fig. 2) somewhat crowded, of moderate length, variable, but usually slender, those of upper arch generally well-developed, occasionally with a few serrations on dorsal margins of one or two lower arch rakers.

Scales adherent; about 17 above and 23 below lateral line at its inflection; right side scales cycloid; primary left side squamation predominately ctenoid, occasionally cycloid on posterior body and caudal peduncle; cteni of moderate length, best developed on head and anterior body; secondary squamation apparently cycloid throughout. Snout, orbits and anterior 2/3 of interorbital naked; scales continue dorsad above and slightly in advance of right eye; largest specimens with 5 or 6 scales on posterior expansion of maxillary; modified scales continue to a greater or lesser extent along all fin rays; pectoral fin base apparently naked; left side squamation complete over remainder of body. Lateral line slightly elevated above pectoral fin, distinct, usually with two or three secondary scales between each pored scale (Fig. 2); secondary squamation sparse or absent elsewhere, usually present only in larger fish, restricted to a single small cycloid scale between lateral angles of adjacent primary scales, apparently most frequent on posterior body dorsad of lateral line.

Upper and lower jaws with a single outer series of fixed teeth and one or more inner series of movable teeth, oriented at approximately 90° from the fixed series, and located on the intraoral integument; each series somewhat laterally offset from the next (Figs. 3 and 4). Movable teeth usually in two series, occasionally three in front; teeth of the 1st series, located immediately behind the fixed teeth, are slightly smaller and straighter than their fixed counterparts; teeth of the innermost series the smallest and straightest. With about 40 close-set, sharp, recurved fixed conical teeth on left side of upper jaw; the anteriormost 4–5 slightly enlarged. Right side of upper jaw with about 44 fixed teeth, similar to but somewhat more slender than those of the left side; the 5–6 enlarged anterior teeth are about 1/5 longer than those of the left. Left side of lower jaw with 15–19 somewhat separated, recurved conical teeth in the fixed series; the first three the largest. Right side of lower jaw with 27–29 teeth in the outer series; the anteriormost 6–7 much the larger; dentition continued much further posteriad than on the left dentary. Teeth of all series gradually decrease in size posteriad.

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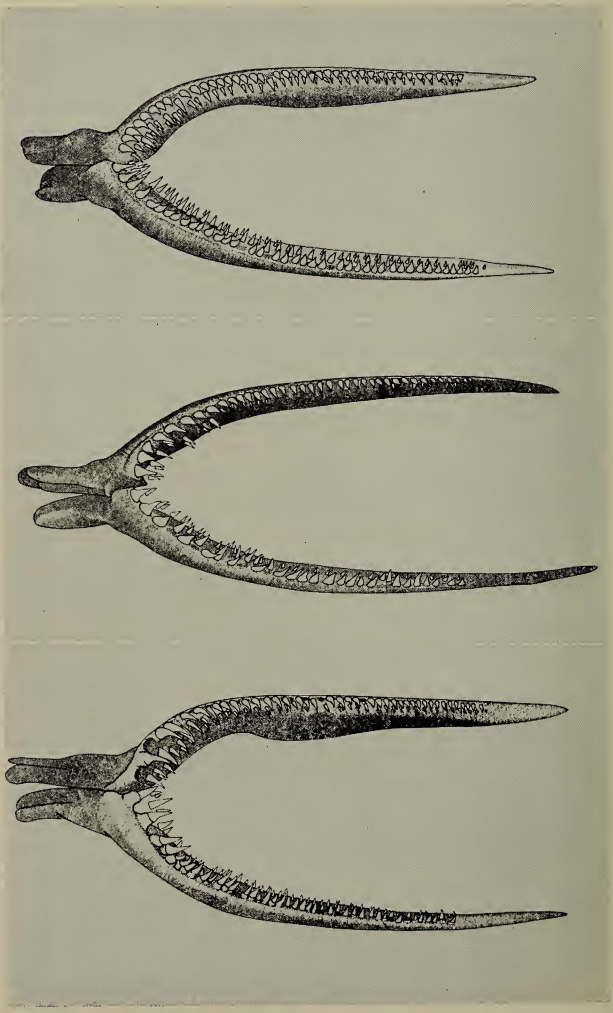
Fig. 2. Upper: Dorsal fin origin, relative lengths of 1st dorsal fin rays, together with insert details of right side nares in *Citharichthys abbotti* (left) and *C. spilopterus* (right). Middle: Usual configuration of gill rakers on 1st left gill arch of *C. abbotti*. Lower: Semidiagrammatic delineation of primary lateral line scales and associated secondary squamation in *C. abbotti*.



Coloration of recently preserved alcoholic specimens similar to that in life. Left side ground color a light sandy-tan; densely speckled with small brown blotches; scales frequently margined with a fine, very dark brown line; fin rays lined with small brown blotches, most specimens with a moderately distinct, darker, blotch on basal one-third of every 5th-8th dorsal and anal fin ray; interradial membranes usually pale; a small, sometimes indistinct, dark brown spot at upper opercular angle; opercle darker than remainder of head, its inner surface dusky-black. Right side mainly cream-white; opercle largely dusky; occasionally with a few widely scattered brown melanophores about mouth and near dorsal margin of snout. Apparently with little variation in general coloration between specimens from differing habitats, but ground coloration is lighter and blotches fewer in juveniles (Fig. 5).

Except where noted, the foregoing description is based on the holotype.

*Distribution*: A western Atlantic species presently known from the Gulf of Mexico shore and various estuarine habitats on the coast of México from Boca del Rio, Veracruz, south to Zacatal, Campeche. Specimens have been collected from depths of 0–2 meters, over substrates ranging from fine sand to dark brown mud. Salinity of 14.8 ‰ and water temperature of 30.1 °C were recorded for the collection of 5 June 1968 (GCRL 2733).

*Etymology*: I take pleasure in naming this species after my colleague, Dr. Walter Abbott, who assisted in the collection of the type series.

*Reversal*: A dextral juvenile (Fig. 5), collected near Boca del Rio (GCRL 2733), is of particular interest in that it is the first known instance of reversal in *Citharichthys*. This fish (15.9 mm SL) has 76 dorsal and 54 anal fin rays, 22 caudal vertebrae and exhibits no other abnormalities. Gudger (1935) did not include *Citharichthys* in his review of reversal in flatfishes and there have apparently been no subsequent records. Noting a disparity between records of reversal in young and adults of the plaice (*Pleuronectes platessa*), Gudger suggested that mortality of reversed young "approaches 100 percent." A similar situation may pertain in *Citharichthys* or reversal may be extremely rare in both young and adults.

*Discussion and Comparisons*: Three species of shallow water *Citharichthys* are presently recognized as occurring in the Gulf of Mexico or Caribbean Sea. *C. spilopterus* (Fig. 6) occurs from New Jersey to Brazil, *C. arenaceus* (Fig. 6) from the West Indies to Brazil and *C. uhleri* (Jordan) Jordan and Goss which is known only from the unique holotype from Haiti. All are similar in general morphology, existing descriptions fail to provide adequate means for their separation and identification of speci-

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Fig. 3. Semidiagrammatic delineations of upper jaw dentition (left side uppermost). Upper: *Citharichthys abbotti*. Middle: *C. spilopterus*. Lower: *C. arenaceus*.

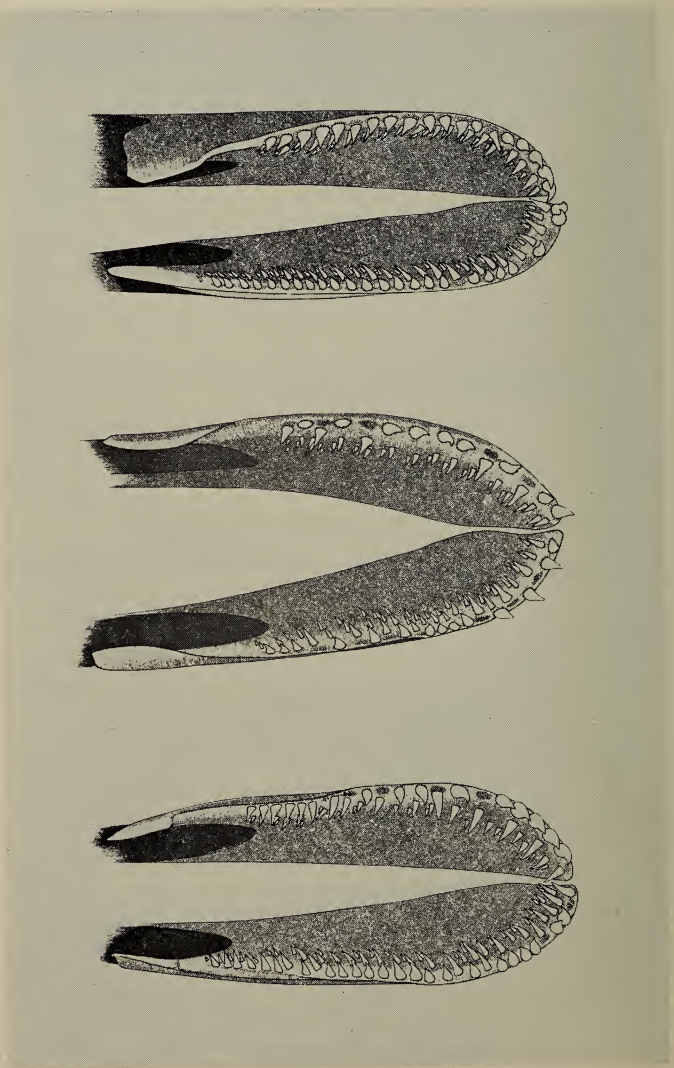

FIG. 5. Juvenile *Citharichthys abbotti* (GCRL 2733). Upper: Typical, sinistral, specimen (15.5 mm SL). Lower: Anomalous, dextral, specimen (15.9 mm SL).

mens from tropical or subtropical waters may be difficult. To these I have now added *C. abbotti* which is similar to both *C. spilopterus* and *C. arenaceus* and sympatric with the former along the Mexican Gulf Coast.

I have not examined *C. uhleri* but the reported combination of 68 dorsal and 52 anal rays, 17–18 gill rakers, 52+ lateral line scales, narrow interorbital, dark brown coloration and 21 caudal vertebrae (personal count from radiograph) clearly separates this species from both *C. abbotti* and *C. spilopterus*. Although *C. uhleri* may eventually prove to be the senior synonym of *C. arenaceus*, it will not be considered further here.

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FIG. 4. Semidiagrammatic delineations of lower jaw dentition (left side uppermost). Upper: *Citharichthys abbotti*. Middle: *C. spilopterus*. Lower: *C. arenaceus*.

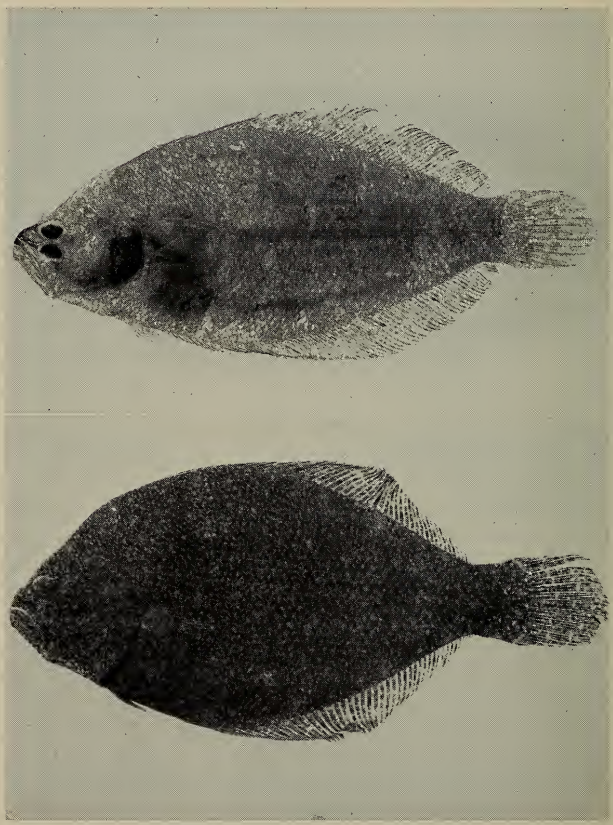

Fig. 6. Upper: *Citharichthys spilopterus* Günther GCRL 2776; 115.0 mm SL. Lower: *C. arenaceus* Evermann and Marsh USNM 203510; 120.0 mm SL.

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Fig. 7. Lateral view of left dentary in three species of *Citharichthys* (110–115 mm SL); indicated teeth are those usually visible in this aspect. Upper: *abbotti*. Middle: *spilopterus*. Lower: *arenaceus*.

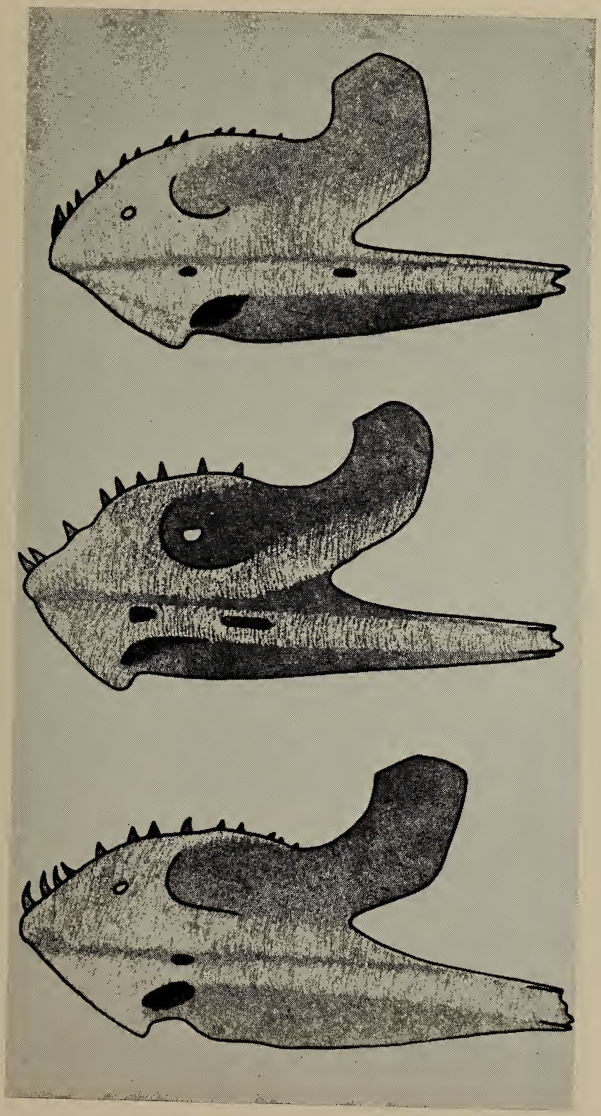

TABLE 5. Observed ranges and means ($\bar{x}$) of selected proportional measurements of *Citharichthys abbotti* (27.6–142.6 mm), *C. arenaceus* (32.6–121.6 mm) and *C. spilopterus* (39.2–132.0 mm) in percent of standard length or head length (HL).

| | *C. abbotti* | | | *C. arenaceus* | | | *C. spilopterus* | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Range | | | Range | | | Range | |
| Character | N | % SL or HL* | $\bar{x}$ | N | % SL or HL* | $\bar{x}$ | N | % SL or HL* | $\bar{x}$ |
| Body depth | 35 | 44.1–51.4 | 47.7 | 29 | 44.9–57.4 | 49.3 | 50 | 40.4–49.9 | 45.6 |
| Caudal peduncle depth | 35 | 11.7–14.4 | 12.9 | 29 | 12.3–15.8 | 13.3 | 49 | 11.0–13.9 | 12.8 |
| Left pectoral fin length | 33 | 12.3–15.0 | 13.8 | 24 | 12.0–15.4 | 13.8 | 50 | 13.8–17.0 | 15.5 |
| Left pelvic fin length | 31 | 9.7–13.0 | 11.7 | 28 | 7.7–12.8 | 10.6 | 49 | 8.4–11.0 | 9.9 |
| Head length | 33 | 27.1–31.3 | 29.3 | 29 | 27.5–32.2 | 28.9 | 49 | 26.3–30.9 | 28.1 |
| Postorbital length* | 33 | 57.6–66.4 | 62.3 | 29 | 59.2–67.7 | 64.4 | 49 | 60.3–71.3 | 64.7 |
| Diameter of orbit* | 33 | 17.0–23.9 | 20.9 | 29 | 17.3–23.3 | 19.6 | 47 | 13.4–24.8 | 20.0 |
| Snout length* | 33 | 18.4–21.0 | 19.8 | 29 | 17.4–20.2 | 18.7 | 43 | 17.6–22.1 | 19.8 |
| Upper jaw length* | 33 | 34.7–39.4 | 37.0 | 29 | 39.1–43.5 | 40.7 | 48 | 35.2–40.1 | 37.4 |
| Lower jaw length* | 33 | 41.7–48.2 | 44.1 | 29 | 45.7–50.5 | 47.9 | 44 | 41.0–47.2 | 44.2 |
| Length of 1st dorsal ray* | 29 | 23.9–31.0 | 27.6 | 27 | 21.6–26.5 | 23.8 | — | — | — |

Fixed teeth of *C. abbotti* are slightly more numerous than those of *C. arenaceus* and *C. spilopterus*, as well as somewhat more regular and, posterolaterally, more strongly recurved (Figs. 3 and 4). Anterior teeth of both *C. arenaceus* and *C. spilopterus* are prominently enlarged and more widely spaced than in *C. abbotti*; those of *C. arenaceus* are caniniform and set in elevated bony sockets. The left premaxillary teeth are continued further posteriad in *C. abbotti*. Movable teeth are longer in *C. arenaceus* and are proportionately smaller and less abundant in *C. spilopterus*. The tooth bearing margin of the left dentary is similar in *C. abbotti* and *C. spilopterus* but longer and less strongly convex in *C. arenaceus* (Fig. 7).

Meristic characters (Tables 1–4) all overlap to some extent but a high degree of species separation is indicated. Analyses of variance show apparent differences to be significant beyond the 1.0 percent level in all but three instances. The number of caudal vertebrae is similar in *C. abbotti* and *C. arenaceus* but different from *C. spilopterus*. There is no significant difference in number of lateral line scales of *C. abbotti* and *C. spilopterus* although these differ from *C. arenaceus*. Similarly, there is no difference in number of lower arch gill rakers of *C. spilopterus* and *C. arenaceus* but both are significantly different from *C. abbotti* in this character. Compared with *C. arenaceus*, *C. abbotti* averages three more dorsal rays, two more anal rays, three less lateral line scales and about three more

gill rakers. Compared with *C. spilopterus*, it averages two less dorsal and three less anal rays, four more gill rakers and one less caudal vertebra.

Proportional measurements also overlap to a considerable degree but in most cases the small observed differences show a high order of significance. The range and means of 11 proportional characters are shown in percent of SL or HL (Table 5). Serial measurements were not made of the 1st dorsal ray in *C. spilopterus* but measurements of a few specimens show it to be short, similar in length to that of *C. arenaceus*. Results of covariance analyses between *C. abbotti* and the other two species, together with regression coefficients and other pertinent data are shown in Table 6.

Right side narial diameters are somewhat greater in *C. spilopterus* and the 1st dorsal ray is inserted above the posterior naris (Fig. 2). Narial diameters of *C. arenaceus* approximate those of *C. abbotti* and dorsal fin origin appears to be intermediate between that of *C. spilopterus* and its anterior location in *C. abbotti*.

*Citharichthys abbotti* is distinct from its compared congeners in a number of meristic and morphometric characters. In some features, such as numbers of vertical fin rays, it is intermediate between *C. arenaceus* and *C. spilopterus*. It is inseparable from *C. arenaceus* on the basis of such characters as vertebral number and pectoral fin length and from *C. spilopterus* in such features as jaw lengths, number of lateral line scales, etc. *C. abbotti* is as distinct from each of these species as they are from each other and I consider it to warrant specific status. Characters most useful in the identification of these forms have been compared in Table 7.

Although presently known only from the southwestern Gulf of Mexico, *C. abbotti* is likely to occur in inshore and estuarine habitats along the Caribbean coast of México and northern Central America.

It should be noted that current literature recognizes only a single row of teeth in the upper and lower jaws of *Citharichthys*. The keys of Norman (1934) and Gutherz (1967) separate *Citharichthys* from *Syacium* Ranzani on the basis that upper jaw teeth are uniserial in the former and biserial in the latter. Whereas this is true for the fixed teeth, at least *Syacium gunteri* Ginsburg and *Cyclopsetta chittendeni* Bean, a related form with uniserial fixed teeth, also have two or three rows of movable teeth in each jaw. Since movable teeth can be seen by careful examination under low magnification, a definite possibility exists for misidentification of these genera. Future keys and descriptions should clearly distinguish between fixed and movable teeth.

*Other Material*: In addition to listed specimens of *C. abbotti*, the following material was examined in this study: *Citharichthys arenaceus*: USNM 49536; holotype; 132 mm SL; Mayaguez, Puerto Rico. USNM 50195; paratypes; (2) 99–100 mm SL; Mayaguez, P. R. USNM 126424; paratypes; (9) 47–103 mm SL; Mayaguez, P. R. USNM 203510; (31) 27–122 mm SL; Dominica, BWI, mouth of Blenheim River; 7 November 1964; V. G. Springer and R. H. Reckenveg coll. GCRL 2832; 95 mm

TABLE 6. Means ($\bar{x}$, $\bar{y}$), standard deviations ($\sigma x$, $\sigma y$), correlation coefficients (r), standard error (Sy) and regression coefficients (by.x) for 11 measurements against SL or HL (*) in *Citharichthys abbotti*, *C. arenaceus* and *C. spilopterus*. F values measure differences between *C. abbotti* and congeners after adjustment for differences between standard lengths of samples. Regression equations are in the form:

$$y = \bar{y} + b(x - \bar{x}).$$

| Character<br>F value | Species | N | $\bar{x}$ | $\sigma x$ | $\bar{y}$ | $\sigma y$ | r | Sy | by.x |
|---|---|---|---|---|---|---|---|---|---|
| Body depth | *abbotti* | 35 | 71.8 | 33.6 | 3.4 | 16.5 | 0.9968 | 1.3201 | 0.4897 |
| F = 11.810[2] | *arenaceus* | 29 | 70.7 | 20.1 | 3.5 | 11.5 | 0.9932 | 1.3680 | 0.5688 |
| F = 28.452[2] | *spilopterus* | 50 | 87.8 | 26.7 | 4.0 | 13.2 | 0.9931 | 1.5624 | 0.4918 |
| Caudal peduncle depth | *abbotti* | 35 | 71.8 | 33.6 | 9.4 | 4.7 | 0.9962 | 0.4110 | 0.1384 |
| F = 6.805[1] | *arenaceus* | 29 | 70.7 | 20.1 | 9.5 | 3.0 | 0.9886 | 0.4657 | 0.1495 |
| F = 2.708 | *spilopterus* | 49 | 87.4 | 26.9 | 11.4 | 3.8 | 0.9912 | 0.5009 | 0.1384 |
| Left pectoral length | *abbotti* | 33 | 72.3 | 34.4 | 10.0 | 4.8 | 0.9946 | 0.5072 | 0.1391 |
| F = 0.008 | *arenaceus* | 25 | 73.4 | 19.8 | 10.1 | 3.1 | 0.9826 | 0.5800 | 0.1520 |
| F = 73.987[2] | *spilopterus* | 50 | 87.8 | 26.7 | 13.6 | 4.0 | 0.9815 | 0.7805 | 0.1482 |
| Left pelvic length | *abbotti* | 31 | 72.9 | 34.8 | 8.4 | 4.0 | 0.9839 | 0.7186 | 0.1115 |
| F = 19.029[2] | *arenaceus* | 28 | 71.1 | 20.3 | 7.5 | 2.2 | 0.9695 | 0.5502 | 0.1049 |
| F = 81.117[2] | *spilopterus* | 50 | 88.7 | 26.2 | 8.8 | 2.6 | 0.9797 | 0.5332 | 0.0984 |
| Head length | *abbotti* | 33 | 71.1 | 32.8 | 20.6 | 9.0 | 0.9982 | 0.5463 | 0.2754 |
| F = 1.030 | *arenaceus* | 29 | 70.7 | 20.1 | 20.3 | 5.5 | 0.9900 | 0.7930 | 0.2722 |
| F = 10.192[2] | *spilopterus* | 49 | 88.7 | 26.1 | 24.9 | 7.2 | 0.9915 | 0.9529 | 0.2757 |
| Postorbital length* | *abbotti* | 33 | 20.6 | 9.0 | 13.0 | 6.0 | 0.9991 | 0.2654 | 0.6681 |
| F = 31.984[2] | *arenaceus* | 29 | 20.3 | 5.5 | 13.2 | 3.8 | 0.9984 | 0.2231 | 0.6961 |
| F = 9.821[2] | *spilopterus* | 49 | 24.9 | 7.2 | 16.2 | 5.2 | 0.9961 | 0.4628 | 0.7174 |
| Diameter of orbit* | *abbotti* | 33 | 20.6 | 9.0 | 4.2 | 1.5 | 0.9921 | 0.1895 | 0.1627 |
| F = 20.930 | *arenaceus* | 29 | 20.3 | 5.5 | 3.9 | 0.9 | 0.9871 | 0.1497 | 0.1641 |
| F = 0.005 | *spilopterus* | 47 | 24.7 | 7.2 | 4.8 | 1.1 | 0.9331 | 0.3984 | 0.1411 |
| Snout length* | *abbotti* | 33 | 20.6 | 9.0 | 4.1 | 1.9 | 0.9980 | 0.1183 | 0.2051 |
| F = 47.410[2] | *arenaceus* | 29 | 20.3 | 5.5 | 3.8 | 1.1 | 0.9914 | 0.1461 | 0.1973 |
| F = 0.662 | *spilopterus* | 43 | 25.6 | 6.5 | 5.0 | 1.2 | 0.9703 | 0.2826 | 0.1722 |
| Upper jaw length* | *abbotti* | 33 | 20.6 | 9.0 | 7.7 | 3.5 | 0.9974 | 0.2564 | 0.3819 |
| F = 134.373[2] | *arenaceus* | 29 | 20.3 | 5.5 | 8.3 | 2.3 | 0.9970 | 0.1843 | 0.4151 |
| F = 0.052 | *spilopterus* | 48 | 24.8 | 7.3 | 9.3 | 2.8 | 0.9925 | 0.3406 | 0.3728 |
| Lower jaw length* | *abbotti* | 33 | 20.6 | 9.0 | 9.0 | 4.0 | 0.9977 | 0.2738 | 0.4403 |
| F = 137.441[2] | *arenaceus* | 29 | 20.3 | 5.5 | 9.7 | 2.6 | 0.9964 | 0.2267 | 0.4750 |
| F = 0.809 | *spilopterus* | 44 | 25.5 | 6.4 | 11.3 | 2.9 | 0.9915 | 0.3820 | 0.4465 |
| 1st dorsal ray length | *abbotti* | 33 | 73.2 | 34.0 | 5.9 | 2.6 | 0.9907 | 0.3560 | 0.0750 |
| F = 85.394[2] | *arenaceus* | 27 | 70.6 | 20.3 | 4.8 | 1.3 | 0.9766 | 0.2911 | 0.0639 |

[1] $P < .05$; [2] $P < .01$.

TABLE 7. Comparison of external characters most useful in distinguishing *Citharichthys abbotti*, *C. arenaceus* and *C. spilopterus*. Means and standard deviations of meristic characters are in parentheses.

| Character | *abbotti* | *arenaceus* | *spilopterus* |
|---|---|---|---|
| Dorsal fin rays | 72–81 (76 ± 1.7) | 70–77 (73 ± 1.6) | 74–82 (78 ± 1.8) |
| Anal fin rays | 52–60 (56 ± 1.5) | 51–56 (54 ± 1.3) | 56–62 (59 ± 1.5) |
| Upper arch gill rakers | 5–8 (6 ± 0.7) | 3–7 (5 ± 0.8) | 3–5 (4 ± 0.6) |
| Total gill rakers | 18–23 (21 ± 1.1) | 15–21 (18 ± 1.2) | 13–19 (17 ± 1.3) |
| Number of lateral line scales | 42–49 (45 ± 1.5) | 45–50 (48 ± 1.3) | 43–48 (45 ± 1.3) |
| Anterodorsal contour | Convex, slight notch before eye | Convex, distinct notch before eye | usually concave |
| Left pectoral fin length | averages 14% of SL | similar to *abbotti* | averages 15.5% of SL |
| Left pelvic fin length | averages 12% of SL | averages 11% of SL | averages 10% of SL |
| Lower jaw length | averages 44% of HL | averages 48% of HL | similar to *abbotti* |
| Length of 1st dorsal ray | averages 28% of HL | averages 24% of HL | similar to *arenaceus* |
| Color in alcohol | Light sandy-tan, sprinkled with brown flecks | Dark brown with tan or light brown flecks | sandy-brown to gray, usually with some brownish flecks on fins |

SL. GCRL 2810; (2) 107–111 mm SL (cleared and stained). Data for GCRL specimens as for USNM 203510.

*Citharichthys spilopterus*: NORTHERN GULF OF MEXICO—GCRL 2776; (15) 82–117 mm SL; 29°42′N, 88°27′30″W; 60 meters; 17 January 1968; R/V GULF RESEARCHER coll. GCRL 2795; (17) 93–113 mm SL; location as for preceding collection; April–June 1967; R/V GULF RESEARCHER coll. GCRL uncataloged; (21) 89–127 mm SL (two cleared and stained); other data as for GCRL 2795.

MÉXICO, Veracruz—GCRL 2367; 128 mm SL; south jetty at Alvarado; 3 September 1967; C. E. Dawson coll. GCRL 2686; (2) 46–62 mm SL; north shore of Laguna Zontecomapan, about 1/4 mi. from mouth; 1 September 1967; C. E. Dawson and W. Abbott coll. GCRL 2687; (5) 39-132 mm SL; south side of Laguna Zontecomapan, about 3/4 mi. from mouth; 1 September 1967; C. E. Dawson and W. Abbott coll. GCRL 2726 (7) 21–85 mm SL; Rio Jamapa, southwest end of bridge on México 180; 5 June 1968; C. E. Dawson and S. Romay coll. GCRL 2734; (16) 40–103 mm SL; Isla da Amor, Boca del Rio; 5 June 1968; C. E. Dawson coll. GCRL 2833; (2) 59–73 mm SL; tidepool on north side of south jetty at Alvarado; 7 June 1968; C. E. Dawson coll. GCRL 2806; (2) 30–33 mm SL; north shore of Isla Pajaritos, Rio Coatzacoalcos; 8 June 1968; C. E. Dawson coll. GCRL 2745; 48 mm SL; mouth of Laguna Zontecomapan; 16 August 1968; C. E. Dawson coll.

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